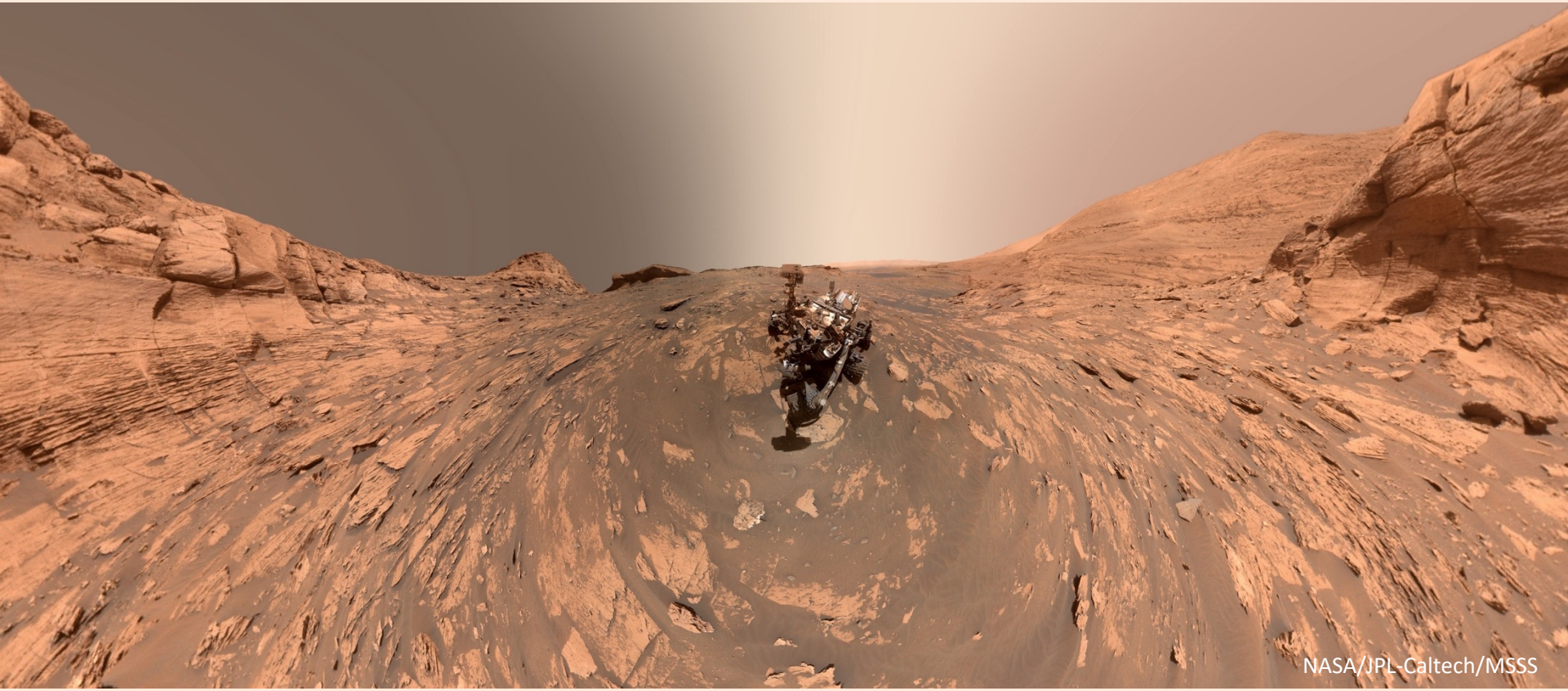
National Aeronautics and Space Administration

Update from the Mars Science Laboratory



Ashwin R. Vasavada
Project Scientist

Abigail Fraeman
Deputy Project Scientist

Jet Propulsion Laboratory,
California Institute of Technology

MEPAG VM#14 - Feb. 2, 2022

MSL Science Team Updates*

ChemCam:

Principal Investigator	Nina Lanza (LANL)
Deputy Principal Investigator	Olivier Gasnault (IRAP)

SAM:

Principal Investigator	Charles Malespin (GSFC)
Deputy Principal Investigator	Amy McAdam (GSFC)

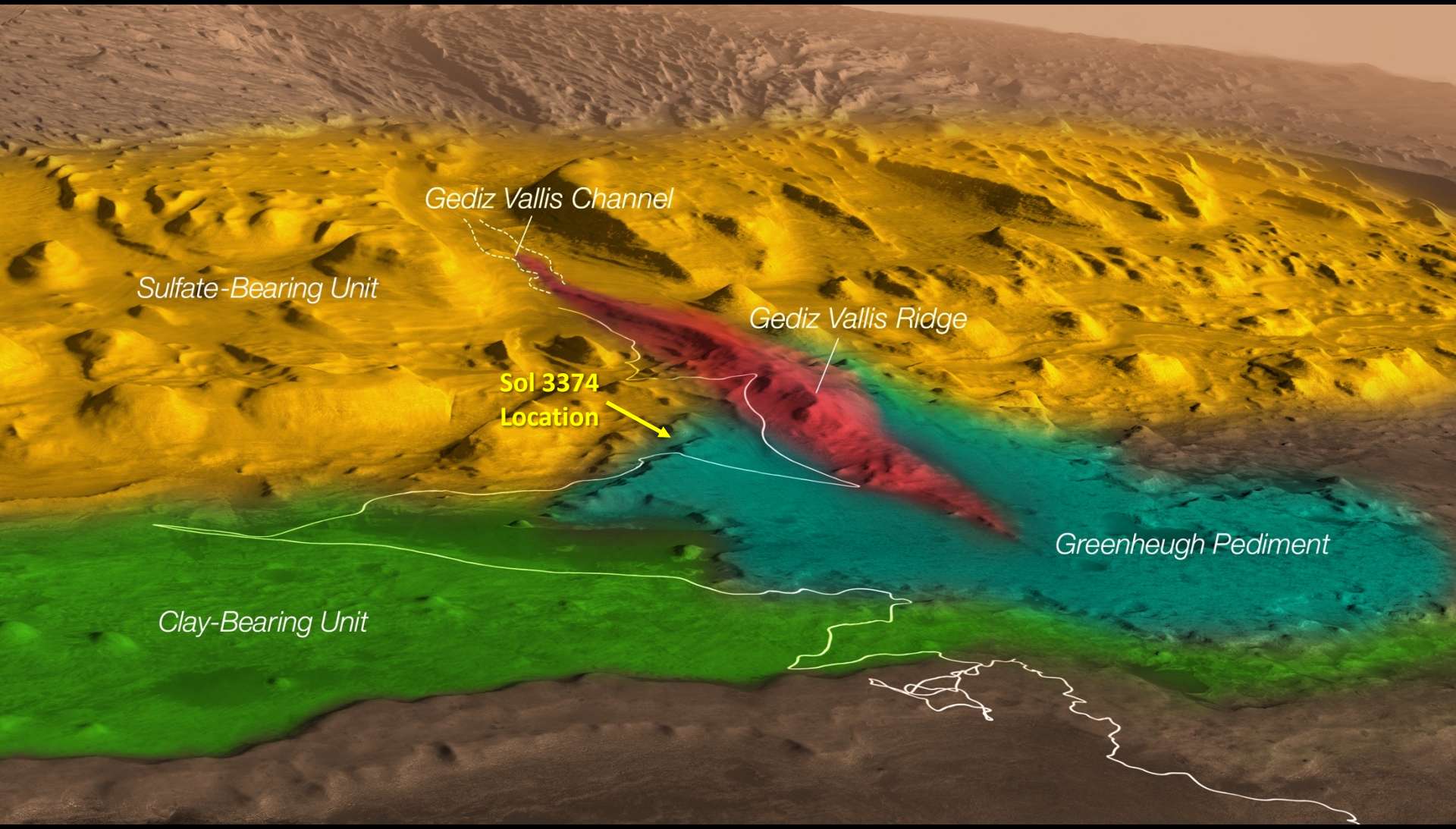
MAHLI:

Principal Investigator	Aileen Yingst (PSI)
Deputy Principal Investigator	Michelle Minitti (Framework)

*Pending final approval from NASA.

MSL Participating Scientists

NASA has selected a new class of MSL Participating Scientists. This is the third class of MSL PS and the first to be selected using Dual-Anonymous Peer Review.

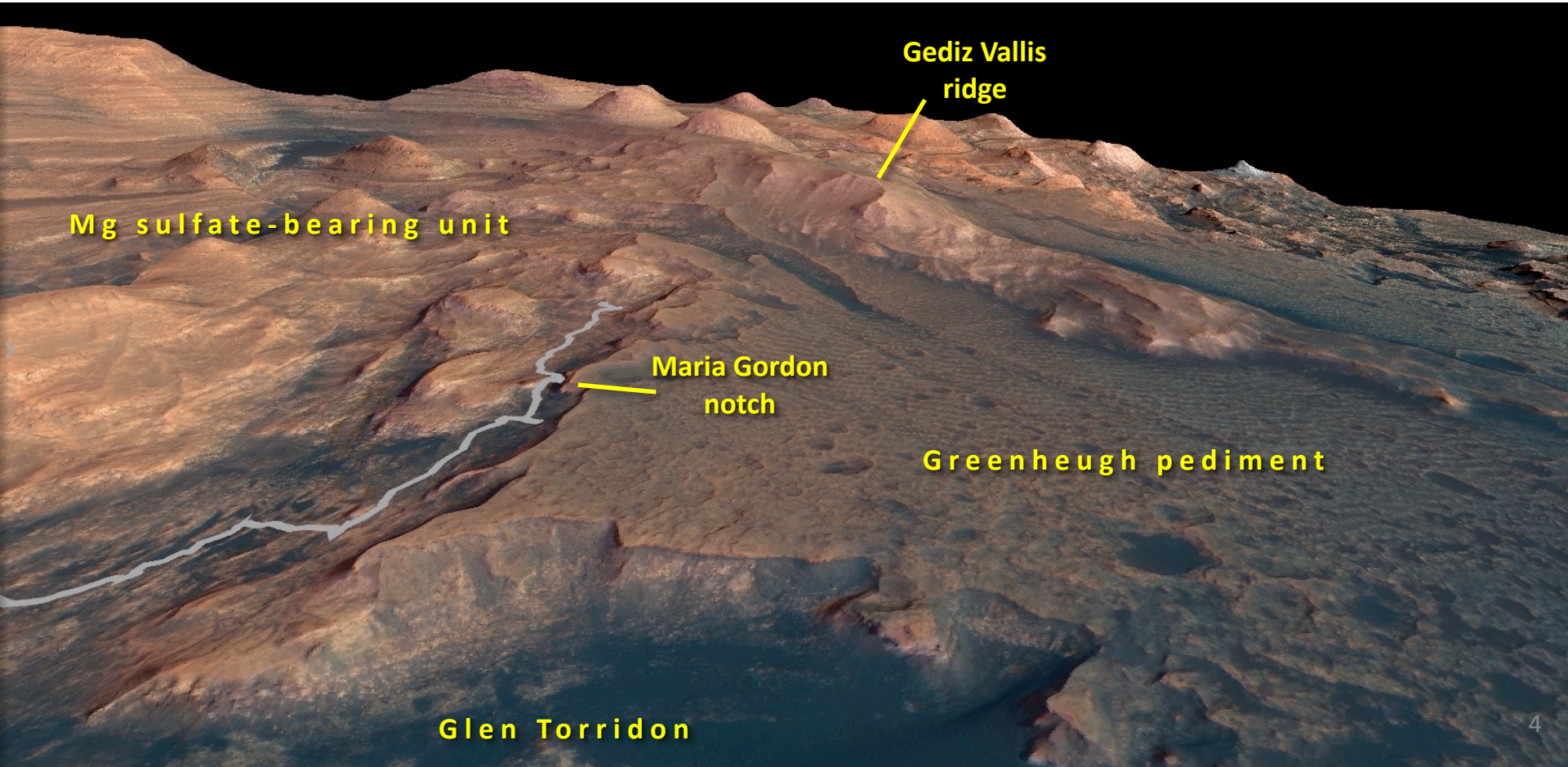


NASA/JPL-Caltech/ESA/University of Arizona/JHUAPL/MSSS/USGS Astrogeology Science Center

Curiosity's Recent Traverse

Mission Status

- Curiosity's science team is completing its investigation of the clay-sulfate transition region between Glen Torridon and the Mg sulfate-bearing unit.
- Subsequently, several months will be spent on the Greenheugh pediment investigating the Gediz Vallis ridge, a feature that may reveal evidence of late-stage fluvial activity and transient lakes in Gale crater.



MSL EXTENDED MISSION 4

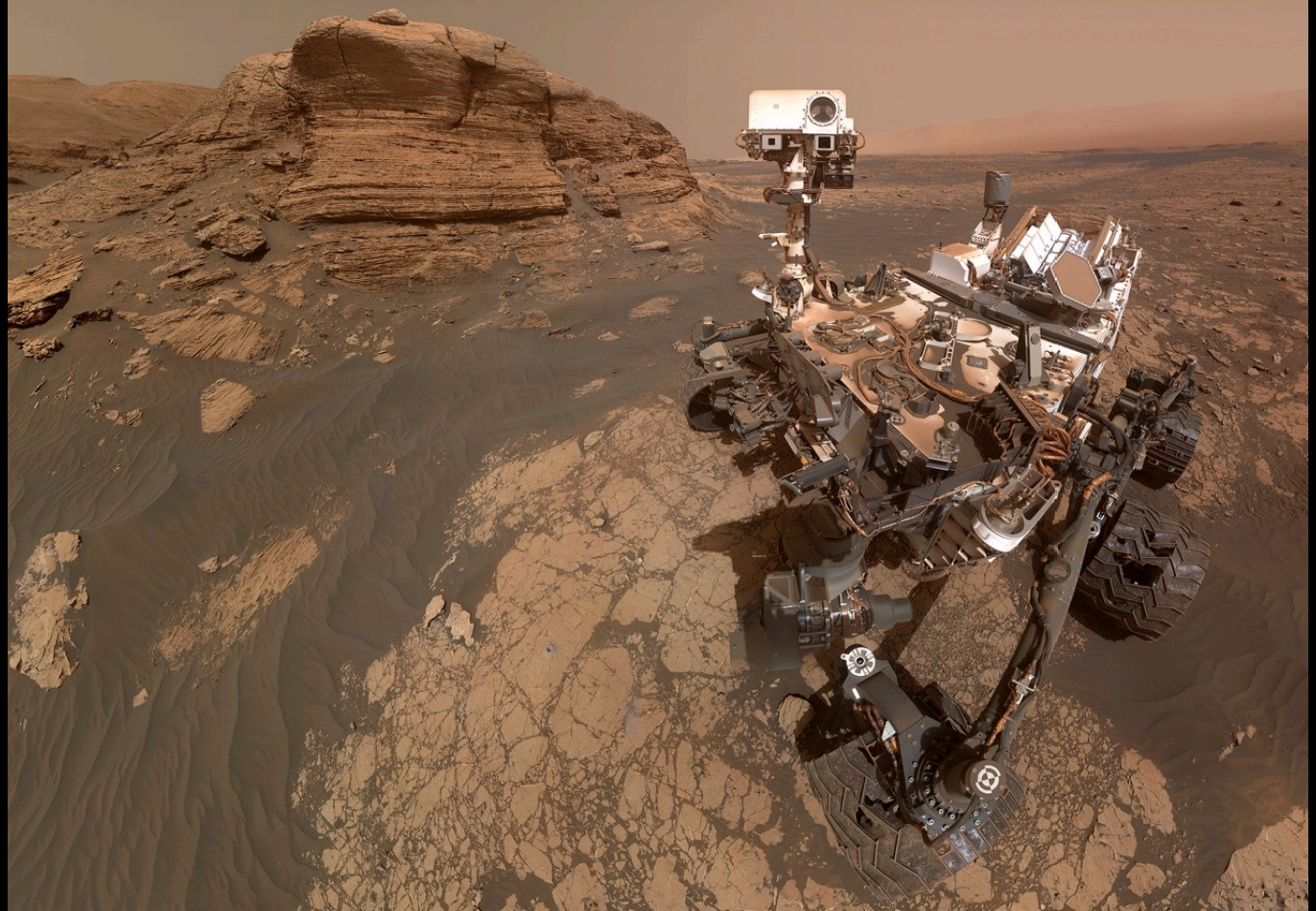
Investigating the Persistence of Habitability through Dramatic Changes in Climate

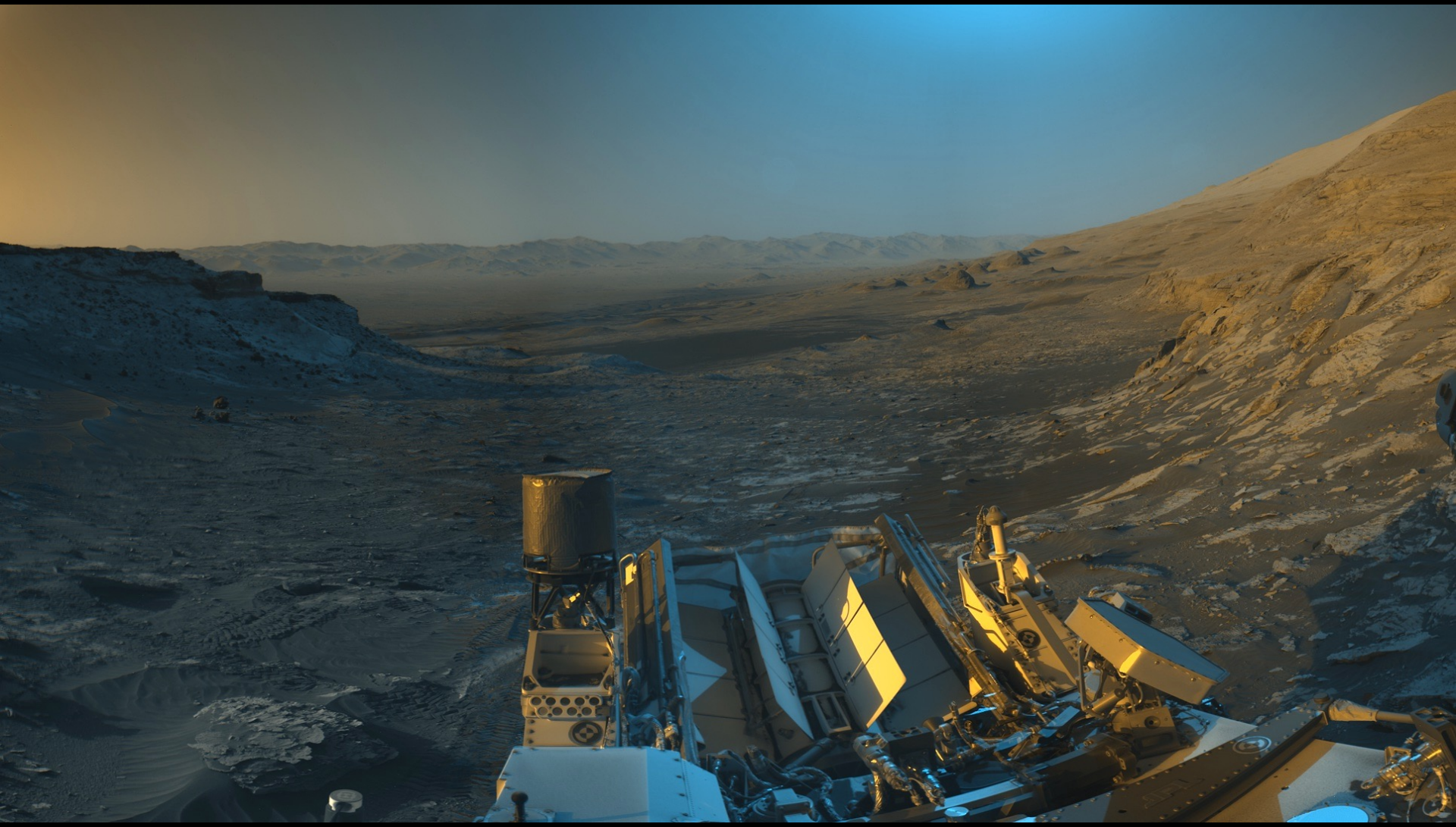
2022 SENIOR REVIEW PROPOSAL

PREPARED BY:

Megan Richardson Lin
Mars Science Laboratory
Project Manager

Dr. Ashwin R. Vasavada
Mars Science Laboratory
Project Scientist

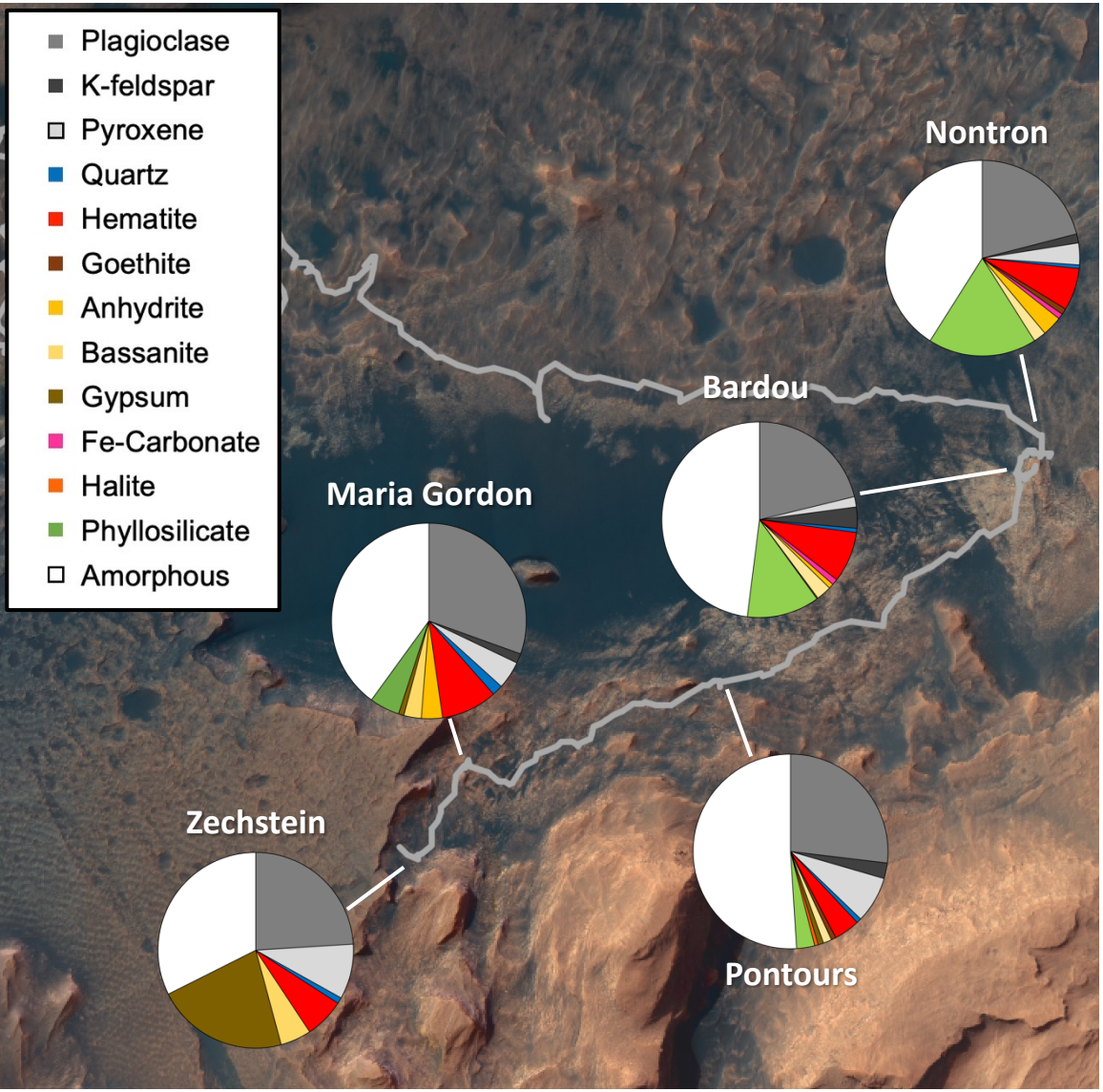




NASA/JPL-Caltech

Time as Color: Sol 3299 Lossless Navcam

Composition Along the Clay-Sulfate Transition

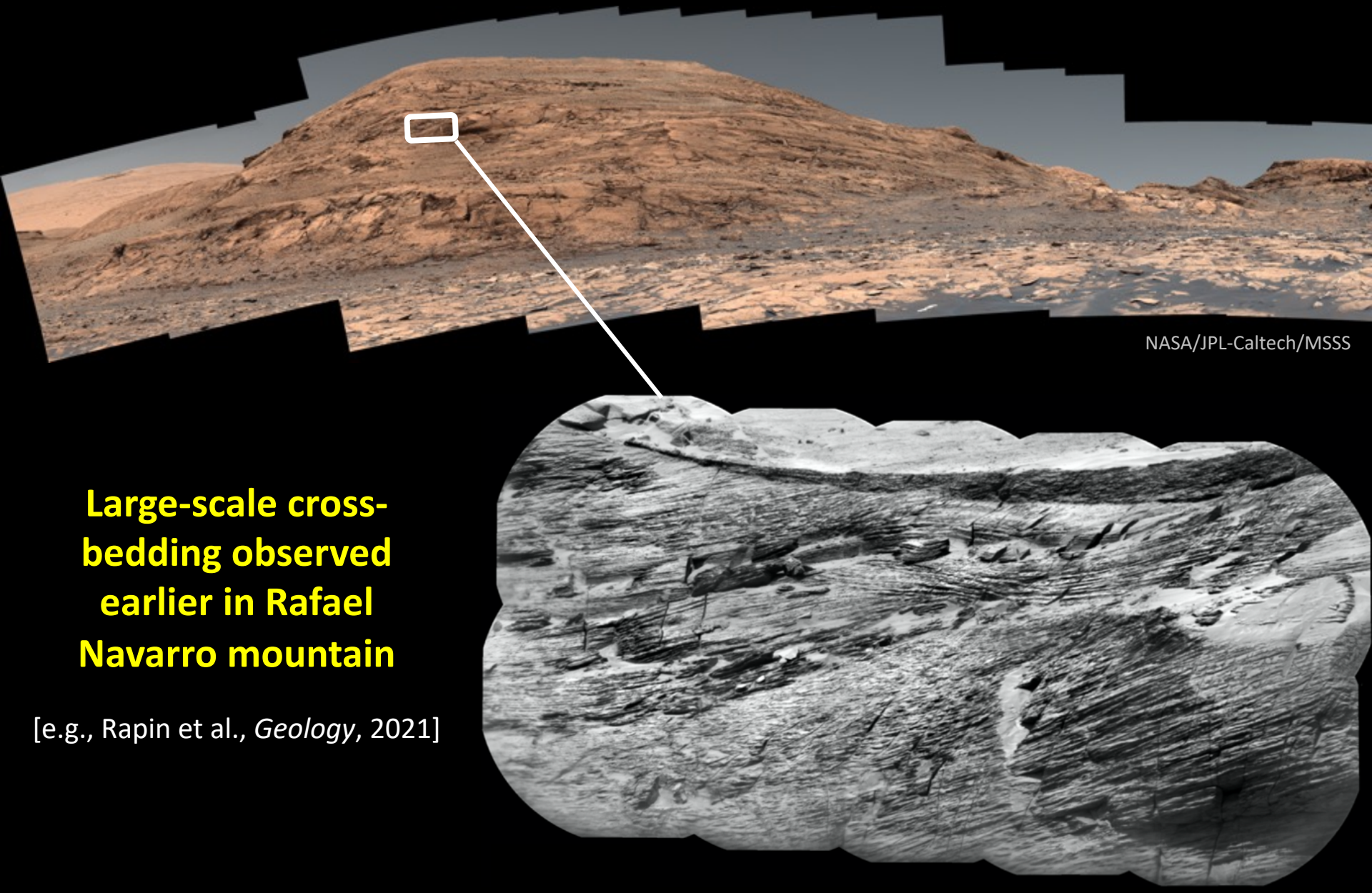


Curiosity's CheMin X-ray diffractometer determined the major constituents:

- Plagioclase feldspar
- Ca-sulfate
- Pyroxene
- X-ray amorphous materials
- Hematite

Clay mineral abundance decreases up-section.

Crystalline Mg-sulfates are not detected, but Mg-sulfates are inferred from ChemCam and APXS spectroscopy, and SAM evolved gas analyses.



NASA/JPL-Caltech/MSSS

NASA/JPL-Caltech/LANL/CNES/IRAP/LPGNantes/CNRS/IAS

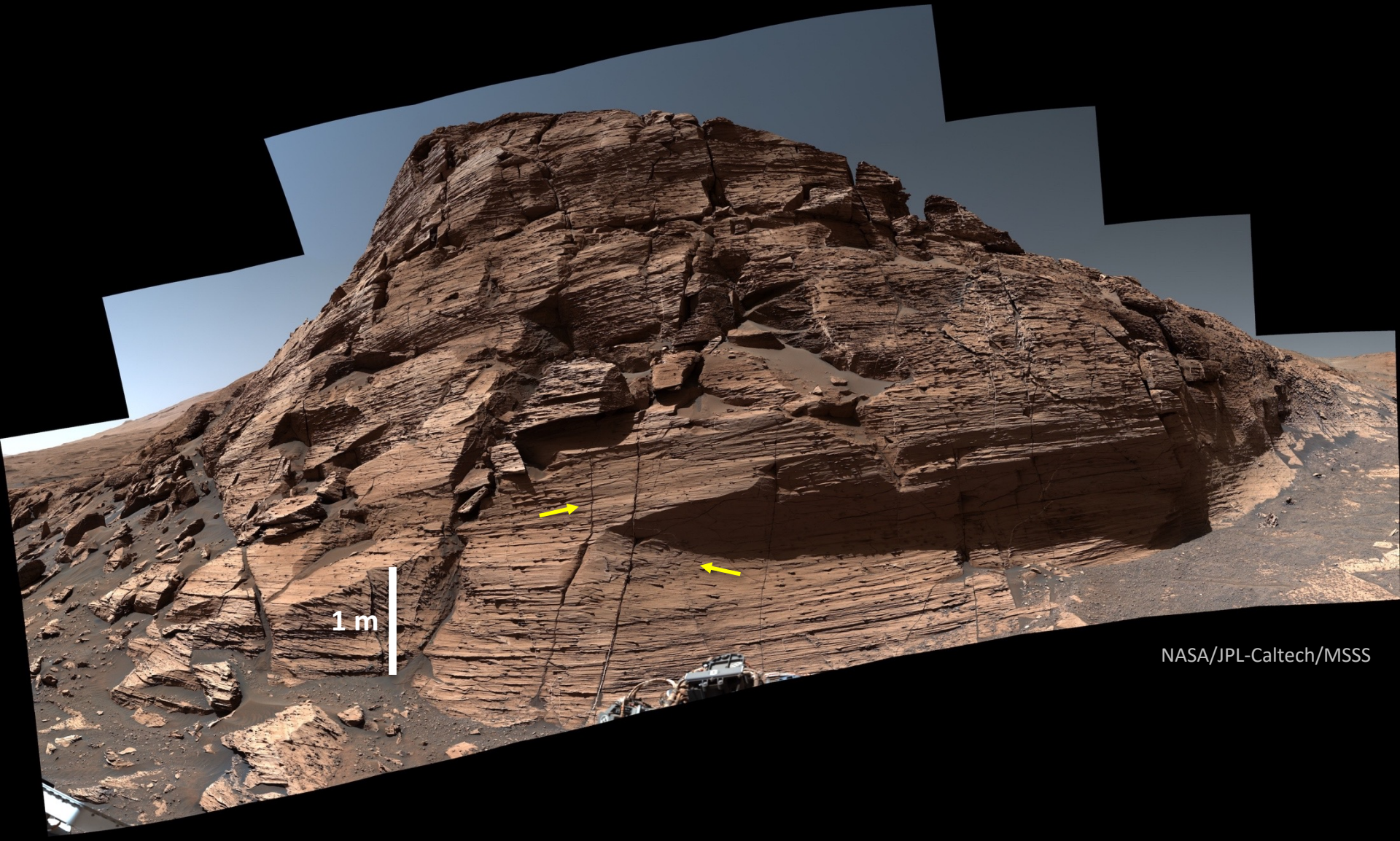
Large-scale cross-bedding observed earlier in Rafael Navarro mountain

[e.g., Rapin et al., *Geology*, 2021]

Sol 3324 - West wall of Maria Gordon notch

NASA/JPL-Caltech/MSSS

Sol 3320 - East wall of Maria Gordon notch



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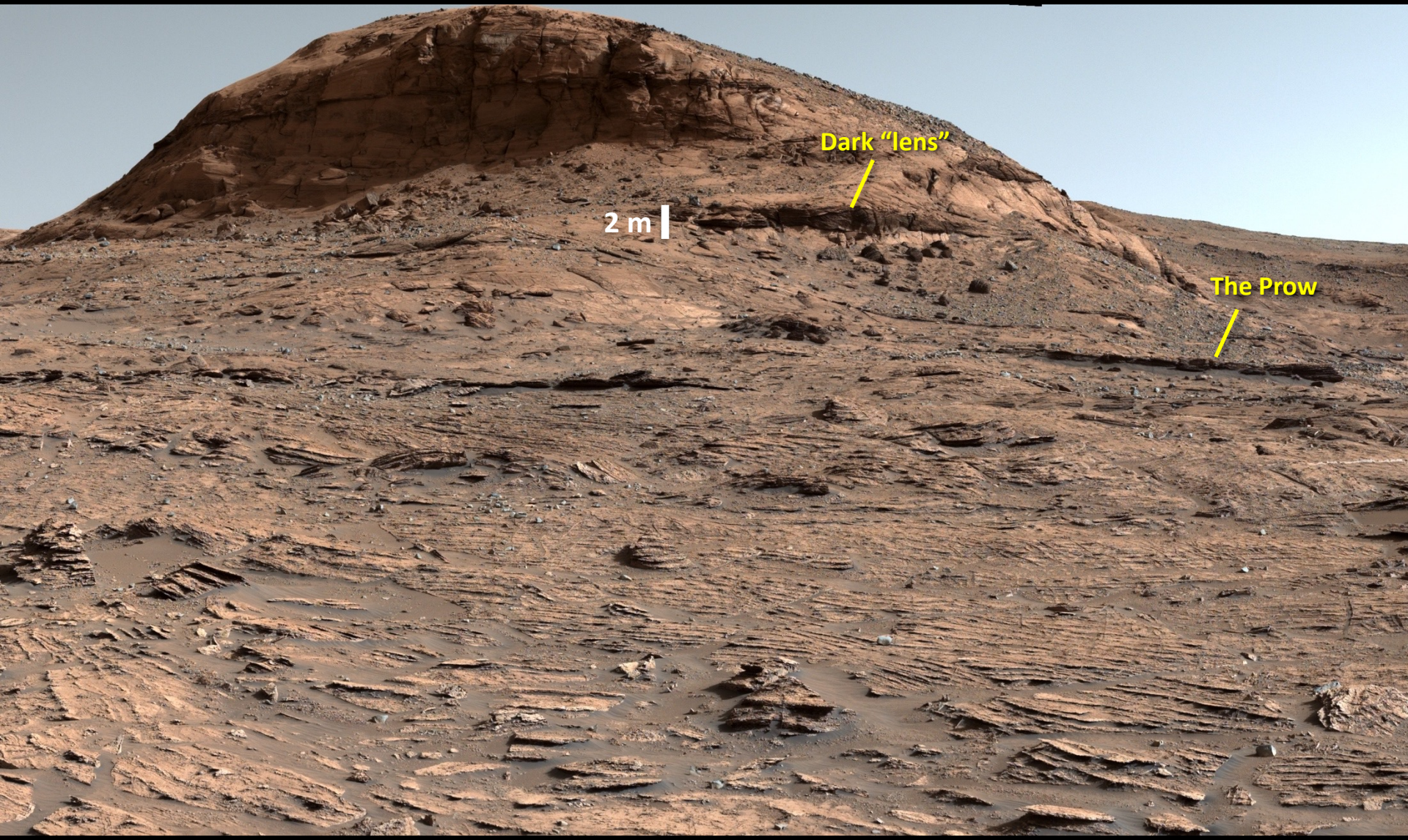
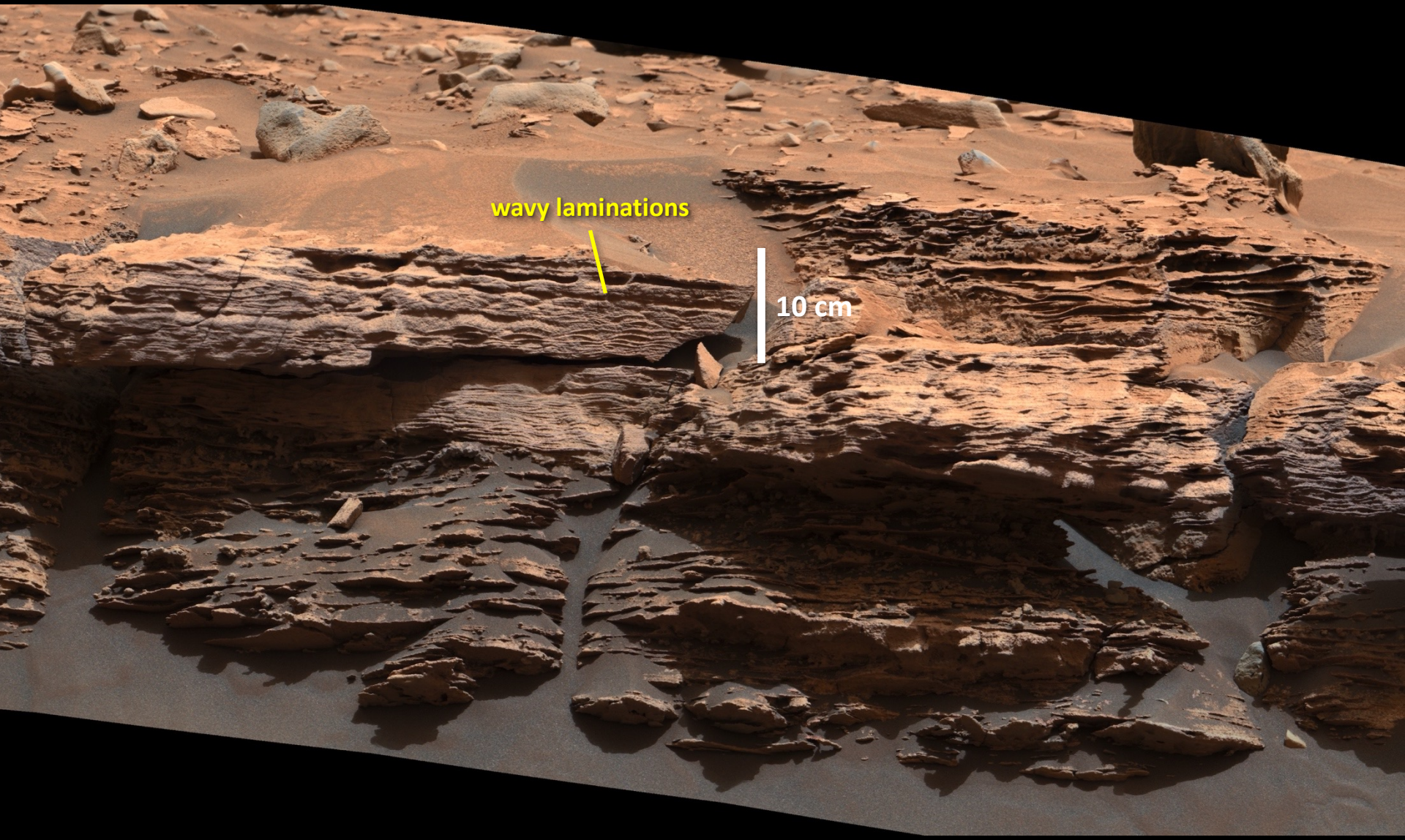


NASA/JPL-Caltech/MSSS

Mirador butte - Sol 3333

Sol 3333

NASA/JPL-Caltech/MSSS



NASA/JPL-Caltech/MSSS

The Prow - Sol 3364

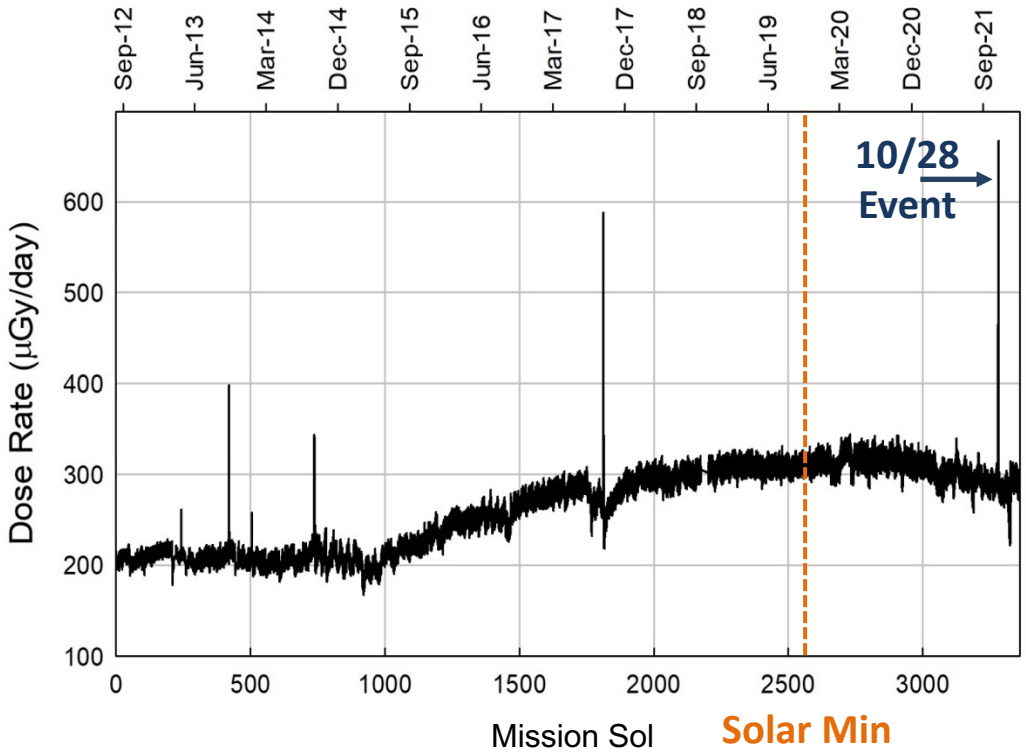
NASA/JPL-Caltech

Effect of Regional Dust Event

Curiosity has observed five Mars years of meteorology!

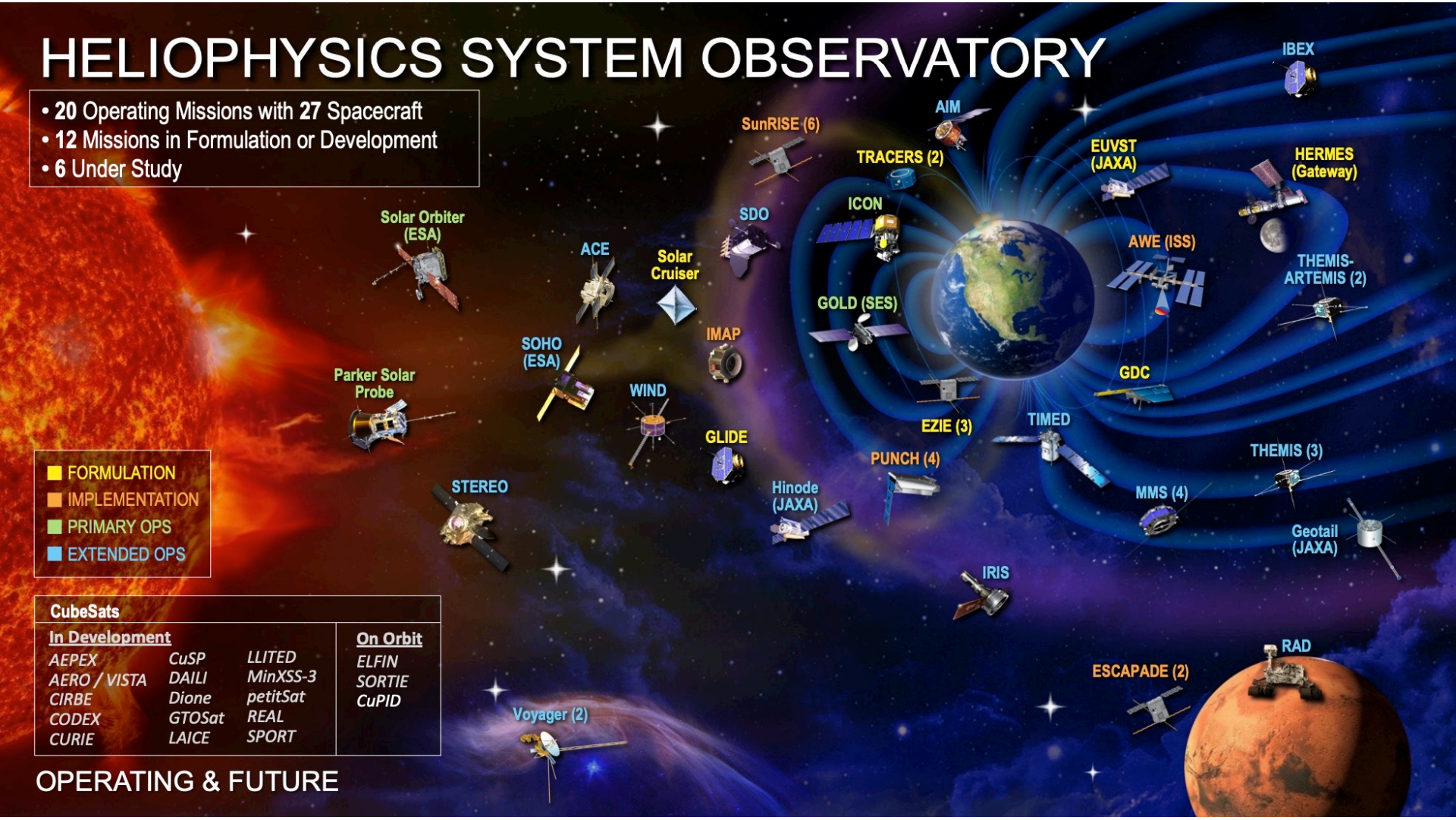
Increasing Solar Activity in Solar Cycle 25

- The radiation dose measured by RAD continues to decrease as the sun heads toward Solar Max
- The background radiation dose at Mars is primarily from galactic cosmic rays; it decreases when the sun has more influence
- On October 28, 2021, RAD observed its largest Solar Energetic Particle event to date. The event corresponds with the first X-class flare of the new solar cycle.
- As the sun heads deeper into Solar Max, solar activity and the occurrence of large SEP events becomes more likely



Curiosity's fourth extended mission (2023-25) will allow RAD to:

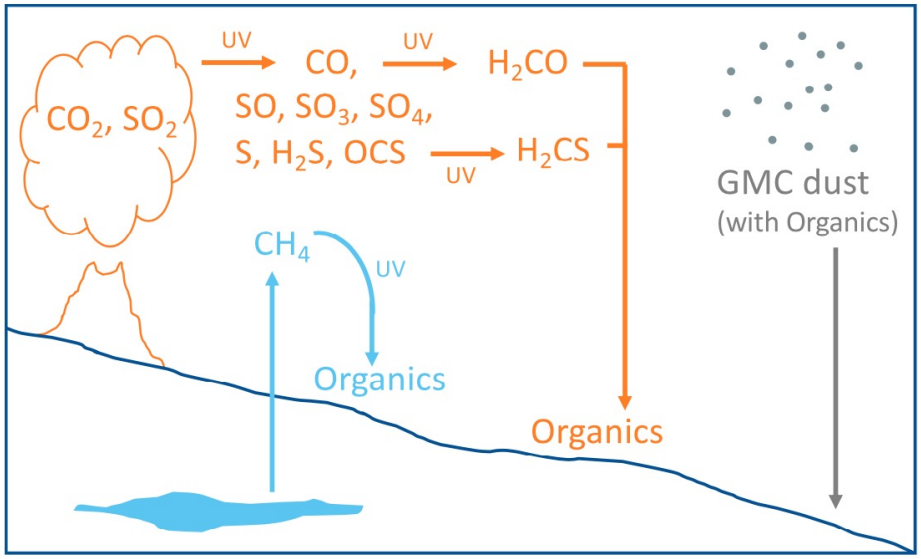
- Observe over an entire 11-year solar cycle
- Characterize potentially large/extreme events which can occur during Solar Max



As of October 2021, the RAD investigation's primary support is from the Heliophysics Division of NASA's Science Mission Directorate, recognizing the importance of RAD as a space weather outpost as part of NASA's Heliophysics System Observatory

Depleted ^{13}C in Methane Evolved from Solid Samples

- A newly published study of the carbon isotopes of methane evolved from 24 drilled samples found values of $\delta^{13}C$ that ranged from -137 to +22 ‰
- Highly depleted ^{13}C values were observed in a variety of targets, including mudstone, the Vera Rubin ridge, a sandstone capping unit, and sand
- One possible commonality is that these sites may have existed along a common paleosurface
- While on Earth such enrichments arise from biology, on Mars plausible explanations include ancient biology, chemical reactions within the ancient martian atmosphere, or deposition of organic-rich dust when Mars traversed through a galactic molecular cloud.



House et al., *PNAS*, https://doi.org/10.1073/pnas.2115651119 (2022)